Goodenia elaiosoma I.D.Cowie (Goodeniaceae), a new species from the Top End of the Northern Territory and a key to the northern species

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Summary

Cowie, I.D. (2005). *Goodenia elaiosoma* I.D.Cowie (Goodeniaceae), a new species from the Top End of the Northern Territory and a key to the northern species. *Austrobaileya* 7(1): 205–213. The new species *Goodenia elaiosoma* I.D. Cowie (*Goodenia* section *Goodenia*, subsection *Borealis*) is described from the western Top End of the Northern Territory. The species is compared with the superficially similar, tropical species *G. armstrongiana* and *G. debilis*. A key to the 43 *Goodenia* species found in the northern Northern Territory is provided.

Key Words: Goodeniaceae, *Goodenia elaiosoma, Goodenia armstrongiana, Goodenia debilis,* new species, key to species, Northern Territory, tropical Australia.

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Introduction

The seasonally waterlogged, infertile, sandy soils of the monsoonal northern Northern Territory (NT) support a diverse assemblage of specialist plant species. Indeed, the area has been identified as a world centre of diversity for the genus *Utricularia* L. (Lentibulariaceae) (Taylor 1989) with 36 taxa known from the area. This diversity is also reflected in other genera associated with such soils including *Eriocaulon* L. with 21 species in the northern NT (Leach 2000) and *Lindernia* All. (under revision but more than 25 taxa in the northern NT (W.R. Barker unpublished data). To a greater or lesser degree, speciation has also occurred in genera such as *Byblis* Salisb. *Calandrinia* Kunth, *Centrolepis* Labill., *Drosera* L., *Fimbristylis* Vahl, *Mitrasacme* Labill., *Oldenlandia* L., *Stylidium* Willd., *Trithuria* Hook.f., and *Typhonium* Schott occurring on seasonally water logged substrates and extends to the wetter end of the drainage continuum with local speciation in shallow water, aquatic genera such as *Hygrochloa* Lazarides and *Nymphoides* Hill. Many of the taxa involved are endemic to the NT, with relatively restricted distributions on the lowlands primarily associated with the Koolpinyah Surface of Williams (1969) or the Western Arnhem Land Plateau (Woinarski *et al.* in prep.). The species composition of this flora appears to vary in response to subtle changes in the texture, drainage and period of inundation of these colluvial and alluvial sandy soils found in drainage depressions, on upstream floodplains, along minor drainage lines and in seepage areas.

In the Darwin area, these soils are extensively exploited as a source of fine sand for building and construction (Doyle 2001) and the long-term conservation status of the flora they support is of some concern. During surveys of this flora in the Darwin-Kakadu area to clarify the distribution, abundance and conservation status of *Utricularia* species in particular, collections were made of an undescribed *Goodenia* Sm. This taxon, although allied to *G. armstrongiana* de Vriese and *G. debilis* A.E.Holland & T.P.Boyle, has characters which clearly set it aside from those species and is described here.

Goodenia Sm. is a genus of *c.* 190 species almost endemic to Australia and occurring in all States and Territories. Seventy-two species are known from the NT. The genus has recently been treated for Australia by Carolin (1990; 1992), although no treatment exists specifically for the NT. A key to the 43 *Goodenia* species found in the NT north of 17° S latitude is provided here to assist with their identification.

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Materials and methods

Morphological characters were examined using fresh and dried material at DNA. Floral characters were primarily measured from rehydrated and spirit-preserved material with supplementary measurements of dried flowers.

The terminology used for *Goodenia* follows that generally accepted for the genus (Carolin 1990, 1992; Holland & Boyle 2002). In particular, the more or less reduced cauline leaves or scales which subtend the flowers are termed bracts. Appendages (bracteoles) may also be present on the flower stalk, which if ebracteolate is termed a pedicel. Where bracteoles are present, that part below the bracteole is termed a peduncle and the part above a pedicel. The term calyx lobes is used here to describe the free parts of the calyx, otherwise known as sepals in the literature. The adaxial corolla lobes are those either side of the split in the side of the corolla tube while the abaxial corolla lobes are the three more connate lobes between them. Species in the key are numbered according to the *Flora of Australia* treatment (Carolin 1992), to allow easy reference to descriptions there and users of the key are referred to that treatment for authors of plant names.

Taxonomy

Goodenia elaiosoma I.D. Cowie, **sp.nov.** Arcte affinis *G. debili* A.E. Holland & T.P. Boyle a corolla purpureo-brunnea et praecipue a semine oblongo cum hilo basali et elaiosomate, sed sine labro a qua differt. **Typus:** Northern Territory. E of Hope Inlet, 12° 25'S, 131° 06'E, 3 June 2000, *I.D. Cowie 8891* (holo: DNA; iso: AD, B, BRI, CANB, K, L, MEL, MO, NSW, NY, PERTH).

Decumbent annual *herb*, stems to 70 cm long, base single stemmed, softly spongy. *Indumentum* of white to stramineous, straight, antrorse, closely appressed hairs 0.3–0.7 mm long, sparse on stems, pedicels, leaf undersurfaces and capsules, more dense on new growth, ovary, calyx and exterior of floral tube; inner surface of corolla in lower half with fine, weak, hyaline hairs. *Leaves* alternate, antrorse, all cauline, sessile, linear, 6–35 mm long, 1–2 mm wide, gradually diminishing in length towards the stem apex, glabrous above, margins entire, slightly recurved. *Inflorescence* a bracteate raceme. *Flowers* solitary; bracts foliaceous; pedicels filiform, patent, 10–18 mm long, bracteoles absent. *Sepals* adnate to ovary almost to apex; lobes linear, 1.0–1.7 mm long. *Corolla* 5–7 mm long, purple brown, end of lobes and wings cream to dark maroon, enations absent, pouch absent; tube 1.2–1.9 mm long; *abaxial lobes* narrowly oblong, 3.3–4 mm long, *c.* 0.8 mm wide, free for 1.7–2.5 mm, wings equal, 1.3–1.7 mm long, 0.8–1.3 mm wide, minutely serrate to erose; *adaxial lobes* free, narrowly oblong, auricle 1–1.3 mm long, *c.* 0.7 mm wide, wings strongly unequal, wing above auricle usually rudimentary for most of its length, 0.5–1.7 mm long, 0.1–0.5 mm wide, opposite wing well developed, 1.2–1.5 mm long, 0.7–1 mm wide, minutely serrate to erose. *Stamens* 2.1–2.3 mm long; filaments linear, 1.4–1.8 mm long; anthers narrowly oblong, 0.4–0.5 mm long, apiculate. *Style* 2.2–2.7 mm long, indusium broadly obovate, 0.6–1 mm long, 0.8–1 mm wide, basal tuft of hairs absent, sometimes with a few subapical hairs to 0.5 mm long, otherwise glabrous, apex concave, bristles 0.1–0.5 mm long, to 0.5 mm long on upper (abaxial) lip. *Ovary* inferior; ovules 6–7. *Capsule* ellipsoidal, 3.7–4.5 mm long, dehiscing deeply. *Seed* stramineous, oblong, biconvex in cross-section, 1.4–2.0 mm long, 0.9–1.1 mm wide, smooth, glossy, obscurely areolate, rimless, wing absent, base asymmetric with a hyaline elaiosome. **Fig. 1.**

***Additional specimens examined*: Northern Territory.** Wangi Road, near Finniss River crossing, 12° 58'S, 130° 45'E, May 2004, *Cowie 9993 & Jacka* (BRI, CANB, DNA, L, NT, MEL, MO); Shoal Bay area, E of Hope Inlet, NT, 12° 25'S, 131° 06'E, May 2000, *Cowie 8885 & Kerrigan* (BRI, CANB, DNA, MEL, MO, NSW); Howard River Floodplain, 12° 28'S, 131° 06'E, May 2001, *Kerrigan 341 & Cowie* (DNA, MEL); 19 km NNW of Twin Falls, 13° 08'S, 132° 45'E, Jun 1980, *Craven 6293* (DNA).

***Distribution and habitat*:** Endemic to the northern NT and known from Finniss River southwest of Darwin to Kakadu National Park (**Map 1**). Grows in *Eriachne burkittii* grassland/sedgeland or *Pandanus* low open woodland, on the margins of non-estuarine floodplains or in seasonally inundated drainage depressions, on sandy substrates.

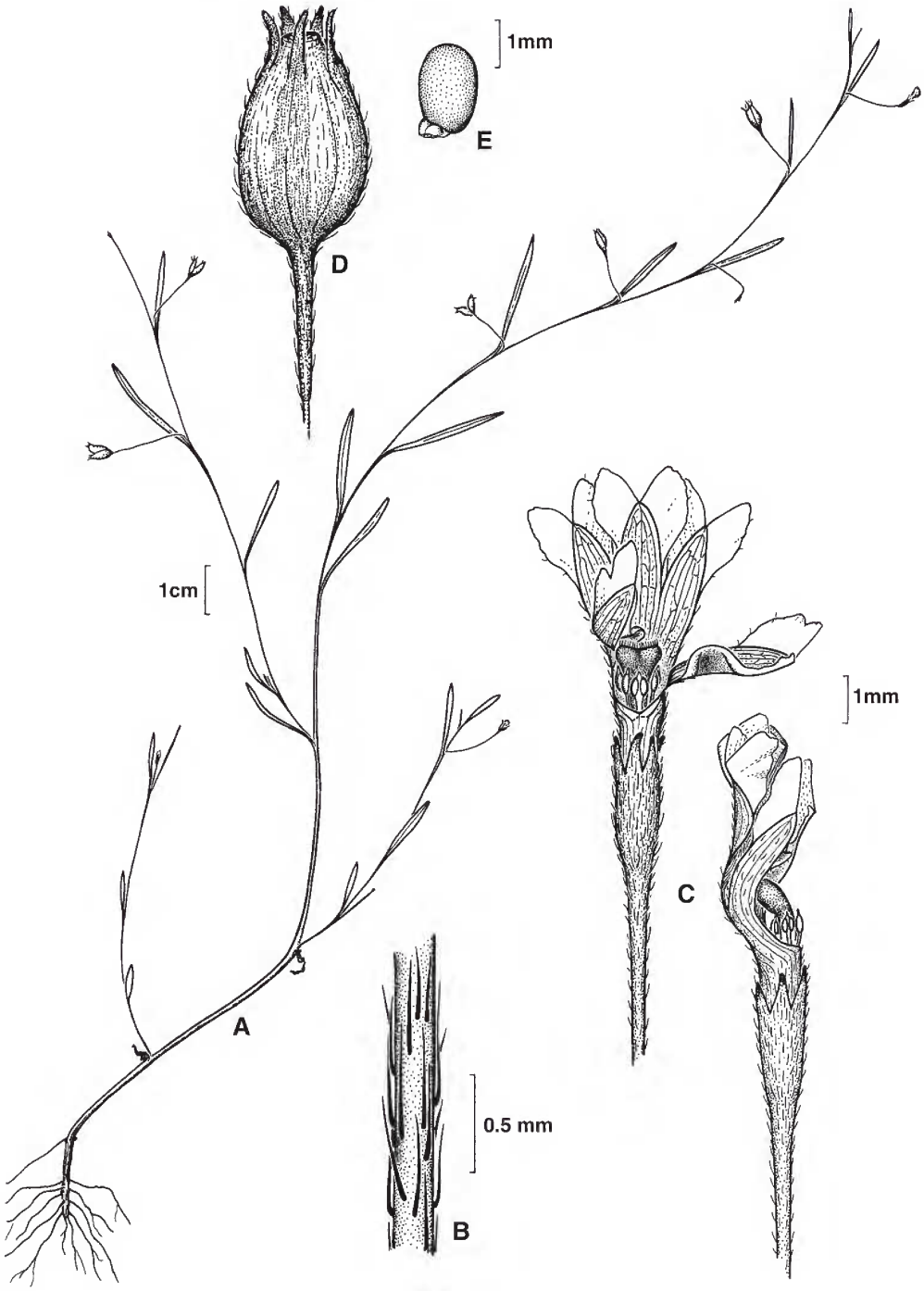
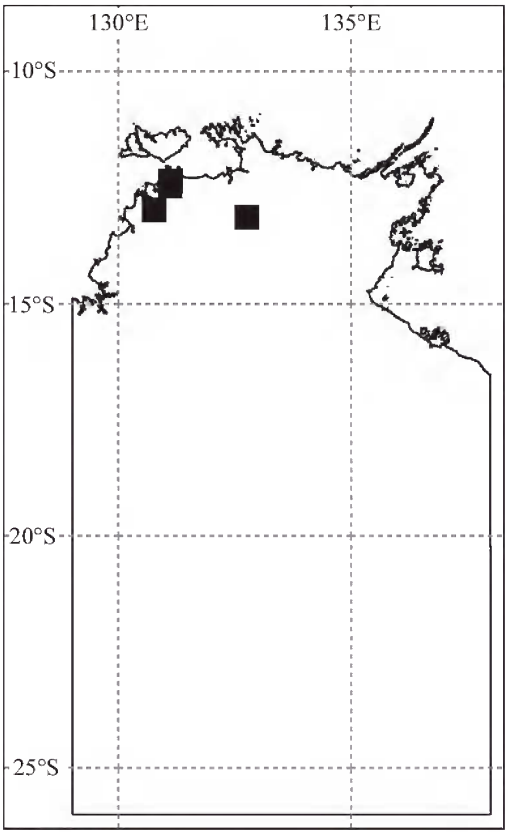


Fig. 1. ***Goodenia elaiosoma.*** A. habit. B. indumentum of stem. C. flower. D. capsule. E. seed. all from *Cowie 8891* (DNA). Scale bars: A. 1 cm; B. 0.5 mm; C, D, E.1 mm. Del. M. Osterkamp Marsden.



Map 1. Distribution of *Goodenia elaiosoma* in the NT.

***Phenology*:** Flowering and fruiting are recorded from April to June.

***Notes*:** *Goodenia elaiosoma* is most closely related to *G. debilis* but differs in having purple-brown flowers and particularly in the seed which is oblong, lacks a rim and has a basal hilum and elaiosome (**Fig. 2**). *G. debilis* has cream or yellow flowers with brownish markings and the seed is elliptic to elliptic-lanceolate, has a narrow rim, with the hilum obliquely lateral at base (**Fig. 2**). Although specimens of both *G. debilis* and *G. armstrongiana* have a narrow membrane around the hilum, this is apparently air-filled and not filled with oily material as in *G. elaiosoma*. *G. elaiosoma* shares with *G. debilis* narrow entire leaves, a shorter corolla, few ovules and an appressed indumentum. Both species lack the prominent basal tuft of hairs on the indusium.

Goodenia elaiosoma differs from *G. armstrongiana* especially by the reduced wing on the adaxial corolla lobes, purple-brown corolla, and the smaller, essentially smooth, oblong, biconvex, rimless, glossy seed with a basal elaiosome. Other differences include the stem which is single and softly spongy at the base; linear leaves; straight, closely appressed indumentum; indusium lacking an often prominent basal tuft of hairs; usually smaller corolla, and fewer ovules. Although variable in leaf dimensions and flower colour, *G. armstrongiana* is characterised *interalia* by antrorse leaves which are more or less dentate, often with basal auricles, a sparse indumentum of curved, appressed to ascending strigose hairs, long filiform peduncles, white to yellow corolla, an indusium with a prominent basal tuft of hairs to 1.5 mm long and seeds which are obovate-oblong to oblanceolate, flattened, verrucate, with a well developed rim, the hilum obliquely lateral at the base (**Fig. 2**). This species is multistemmed at the base with wiry stems. *G. elaiosoma* is sometimes sympatric with *G. armstrongiana* (e.g. at Finniss River), where both species maintain their identities without forming hybrids. Populations of *G. elaiosoma* are geographically disjunct from those of the north Queensland *G. debilis*.

Like *Goodenia armstrongiana* and *G. debilis*, *G. elaiosoma* belongs in *G.* section *Goodenia*, subsection *Borealis* Carolin (Carolin 1992).

***Conservation status*:** The species is known from five locations, with a range extending some 250 km. Two populations fall within Shoal Bay Conservation Reserve east of Darwin while a third lies in Kakadu National Park. A fourth population is known from an area previously disturbed by mining. Although plants at each population were locally common, with plants at Finniss River abundant and estimated at approximately 1 plant m^2 over an area of several hectares, little is known of the true size and extent of populations. Outside of the two reserves, the poorly drained sands inhabited by this species in the Darwin area have been extensively taken up for mining and are heavily exploited. Despite extensive survey work in suitable habitat in the Darwin area, no other populations were found. However, large areas

Fig. 2. Seeds of *Goodenia armstrongiana*, *G. debilis* and *G. elaiosoma*. From left to right A. *G. armstrongiana* (*Orr* 222). B. *G. armstrongiana* (*Cowie 8576*). C. *G. debilis* (*Forster 22614*). D. *G. elaiosoma* (*Cowie 8891*).

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of its range to the east of Darwin and in Kakadu National Park have not been intensively surveyed at an appropriate scale or time of year. Using IUCN criteria, a conservation code of Data Deficient is recommended (IUCN 2001).

***Etymology*:** From the Greek, *elaion* – oil and *soma* – a body, a reference to the elaiosome found on the seed.

Key to *Goodenia* species in the Northern Territory north of 17°S latitude

Species in the key are numbered according to the *Flora of Australia* treatment (Carolin 1992), to allow easy reference to descriptions there and users of the key are referred to that treatment for authors of plant names. It is recognized that a number of complexes are in need of further study (e.g. *G. janamba* Carolin – *G. coronopifolia* R.Br., *G. byrnesii* Carolin – *G. malvina* Carolin – *G. campestris* Carolin and *G. leiosperma* Carolin – *G.* sp. Melville Island).

1. Style 2–4 fid . . . . . **GROUP 1**
   Style unbranched 2

2. Herbs with stoloniferous stems or plants compact and cushion-like; flowers 2 mm long or less, dark red to red-purple, lobes equal, wings obsolete or absent . . . . . **GROUP 2**
   Decumbent to erect herbs, stems not stoloniferous; flowers almost always more than 2 mm long, blue, purple-brown to yellow or white; wings usually well developed, rarely absent 3

3. Leaves either mostly clustered on a short rosette-like basal stock or scattered along a short stem; inflorescence distinct with few leaf-like bracts (i.e. scapose or scapiform) . . . . . **GROUP 3**
   Stems foliose throughout or with leaf-like bracts predominant in inflorescence (stems sometimes reduced or sometimes a few basal leaves present) . . . . . **GROUP 4**

GROUP 1

1. Style 4-fid; corolla yellow-brown . . . . . **176. G. quadrifida**
   Style 3-fid; corolla yellow, purple or brownish-purple 2

2. Corolla yellow, at least on wings 3
   Corolla purple or brownish-purple 6

3. Simple hairs predominating on young leaves, bracts and pedicels, rarely almost glabrous . . . . . **160. G. pilosa**
   Glandular hairs predominating on young leaves, bracts and pedicels 4

4. Seeds smooth; corolla with simple strigose hairs outside, a few glandular hairs sometimes present . . . . . **170. G. neglecta**
   Seeds granulate to verrucate; corolla glandular-pubescent outside 5

5. Cauline leaves usually with 1 or 2 acute teeth at the base, thus auriculate; central indusium ovate to broad ovate; corolla (5.5–) 14–20 mm long . . . . **172. G. holtzeana**
   Cauline leaves petiolate or sessile, never with two broad basal teeth; central indusium depressed-ovate; corolla 10–12 mm long . . . . . **173. G. heppleana**

6. Seeds granulate to verrucate; corolla glandular pubescent outside, simple strigose hairs absent . . . . . **175. G. purpurea**
   Seeds smooth; corolla with simple strigose hairs outside, glandular hairs also present 7

7. Glandular hairs numerous and conspicuous on the flower and pedicel; leaves oblanceolate to narrowly oblanceolate; corolla 8–15 mm long . . . . . **174. G. symonii**
   Glandular hairs few and inconspicuous on the flower and pedicel; leaves very narrowly lanceolate to linear; corolla 7–8 mm long . . . . . **168. G. porphyrea**

GROUP 2

1. Leaves to 80 mm long; inflorescence a compact head at ground level **165. G. chthonocephala**
   Leaves to 25 mm long; flowers solitary or in condensed terminal racemes 2

2. Hairs on leaves simple . . . . . **178. G. kakadu**
   Hairs on leaves stellate . . . . . **177. G. pumilio**

GROUP 3

1. Leaves scattered along a short stem 2
   Leaves mostly on a short rosette-like basal stock 3

2. Leaves linear, less than 5 mm wide; capsule cylindrical; seeds reticulate-foveolate . . . . . **13. G. gloeophylla**
   Leaves oblanceolate, more than 10 mm wide; capsule ovoid; seeds colliculate-punctate . . . . . **27. G. scaevolina**

3. Seeds much less than 1 mm diam., numerous in capsule; bracteoles present 4
   Seeds more than 2 mm diam., often few in capsule; bracteoles absent 10

4. Corolla lobes white to purple or blue 5
   Corolla lobes yellow or yellow and purple 8

5. Corolla 2–3(–5) mm long mostly white with pale purple markings; corolla wings almost obsolete; seeds smooth . . . . . **19. G. minutiflora**
   Corolla 4 mm or more long, wings 1–2 mm wide 6

6. Leaves resinous-viscid with glandular and simple hairs; corolla dark purple-blue; capsule 1.5–3 mm long; seeds smooth to reticulate ..... **20. G. viscidula**
Leaves not viscid, glabrous or with simple hairs; corolla almost white to purple; capsule 2–5 mm long; seeds smooth 7

7. Corolla purple to white-mauve, 8–13 mm long, wings 1–2 mm wide .... **18. G. purpurascens**
Corolla bluish-purple, 4–5 mm long; wings *c.* 1 mm wide ..... **21. G. paludicola**

8. Plant annual; scapes with glandular and patent simple hairs; abaxial corolla lobes yellow, adaxial corolla lobes purplish; leaves usually obovate; seeds reticulate-foveolate ..... **16. G. bicolor**
Plant usually perennial; scapes glabrous or only with simple hairs; corolla lobes yellow throughout; leaves mostly linear-lanceolate to linear-oblanceolate; seeds smooth 9

9. Leaf veins obscure; indusium notched and folded longitudinally ..... **11. G. gracilis**
Leaf veins 3, prominent; indusium concave ..... **15. G. lamprosperma**

10. Calyx lobes markedly unequal, adaxial calyx lobe much longer than others; seeds reticulate, wing 0.2–0.4 mm wide; dwarf plant ..... **136. G. redacta**
Calyx lobes all equal, adaxial calyx lobe equal to others; seeds smooth or reticulate, wing to 1 mm wide; erect plant 11

11. Leaves linear to oblong-elliptic, dentate to pinnatisect, lobes acute; indusium obdeltoid; seeds reticulate, wing *c.* 0.5 mm wide ..... **106. G. coronopifolia**
Leaves narrowly oblong to oblanceolate with a few blunt teeth; indusium broadly oblong; seeds smooth, wing *c.* 1 mm wide ..... **130. G. janamba**

GROUP 4

1. Cauline leaves and bracts appressed to stem, antrorse (pointing upwards) ..... **166. G. armstrongiana**
Cauline leaves and bracts spreading to patent, antrorse or not 2

2. Ovary with mostly glandular hairs or calyx lobes attached in lower half of capsule or both 3
Ovary with mostly simple hairs (often tubercular based) or glabrous; calyx lobes attached in upper half of capsule 8

3. Cauline leaves terete or linear, less than 2.5 mm wide 4
Cauline leaves linear to obovate, more than 3 mm wide 6

4. Upper stems strongly flexuose (zig-zag); ovules 4–6; seeds aculeate (covered in prickles), wing 0.1–0.2 mm wide ..... **138. G. cirrifica**
Upper stems more or less straight; ovules more than 20; seeds colliculate (covered with small rounded projections), wing 1 mm or more wide 5

5. Plant single stemmed at base; leaves mostly more than 40 mm long, not viscid and varnished; abaxial corolla lobes often wingless or with reduced wings ..... **141. G. triodiophila**
Plant many-stemmed at base; leaves mostly less than 40 mm long, often viscid and varnished; abaxial corolla lobes with well developed wings . **139. G. armitiana**

6. Annual herb; leaves and stems with simple hairs only; corolla 11–17 mm long; northern ..... **162. G. potamica**
Perennial herb or subshrub; leaves and stems with glandular hairs; corolla 20–25 mm long; southern 7

7. Leaves ovate to orbicular; corolla yellow; seeds verrucose (covered with small wart-like projections), wingless; southern Gulf ..... **46. G. grandiflora**
Leaves oblanceolate to obovate; corolla blue to mauve; seeds colliculate-punctate, wing *c.* 0.1 mm wide; Victoria River area ..... **27. G. scaevolina**

8. Calyx lobes markedly unequal, adaxial calyx lobe much longer than others; seeds reticulate, wing 0.2–0.4 mm wide ..... **136. G. redacta**
Calyx lobes all equal, adaxial calyx lobe equal to others; seeds smooth to verrucose or aculeate, wing usually absent 9

9. Flowers sessile; corolla to 5 mm long; seeds verrucose, granulose ... **164. G. subauriculata**
Flowers pedicellate; corolla more than 5 mm long; seeds various 10

10. Indusium folded longitudinally, with furrow on upper surface; corolla 5–7 mm long; seeds aculeate (covered in prickles), reticulate, wing 0.1–0.2 mm wide ..... **137. G. odonnellii**
Indusium concave, not folded (rarely grooved); corolla 7 mm or more long 11

11. Calyx lobes 7–12 mm long and 1.5–2 wide 12
Calyx lobes less than 7 mm long or less than 1 mm wide or both (rarely more than 7 mm long but then 1 mm wide or less) 13

12. Seeds verrucose to aculeate ..... **154. G. sepalosa**
Seeds smooth ..... **158. G. durackiana**

13. Seeds smooth to minutely colliculate-alveolate or reticulate 14
Seeds verrucose, granulose 18

14. Seeds biconvex, lacking a rim or wing, basal elaiosome present; corolla purple-brown; calyx lobes less than 2 mm long ..... **G. elaiosoma**
Seeds flattened or concavo-convex, rimmed or winged, lacking an elaiosome; corolla more or less yellow; calyx lobes usually more than 2 mm long 15

15. Cauline leaves entire, petiolate, base long attenuate; seeds reticulate, prominently winged ..... **108. G. strangfordii**
Cauline leaves and bracts usually dentate, sessile or with a short petiole, base rounded to cordate; seeds smooth or minutely colliculate-alveolate, rimmed but almost wingless 16

16. Inner surface of corolla densely pubescent; calyx lobes 5–11 mm long; corolla 15–23 mm long; abaxial corolla lobes 5–8 mm long; capsule 5–8 mm diam. **157. G. leiosperma**
Inner surface of corolla with few hairs; calyx lobes 2–5 mm long; corolla less than 14 mm long; abaxial corolla lobes 2–5 mm long; capsule less than 5 mm diam. 17

17. Stems glabrous, ovary glabrous or with a few strigose hairs ..... **167. G. argillacea**
Stems with scattered hairs, ovary densely hairy .. **G. sp. Melville Island (N.B.Byrnes 666)**

18. Cauline leaves and bracts shortly petiolate, auricles absent or inconspicuous; calyx lobes 1.2–2 mm wide ..... **156. G. brachypoda**
Cauline upper leaves and bracts sessile and often conspicuously auriculate; calyx lobes 1 mm or less wide 19

19. Corolla 7–14 mm long; stems glabrous or with a few coarse hairs 20
Corolla 15–25 mm long; stems sparsely hirsute to hispid, rarely glabrous 21

20. Calyx lobes 1–2 mm long; corolla yellow, 7–8 mm long, abaxial corolla lobes shorter than their connate part . . . . . **160. G. campestris**
Calyx lobes 2–4 mm long; corolla mauve, sometimes more or less yellow towards top, 9–14 mm long; abaxial corolla lobes at least as long as their connate part . . . . . **161. G. malvina**

21. Capsule ellipsoidal; calyx lobes 0.4–0.6(–0.8) mm wide, hispid; leaves (7–) 10–20 mm wide . . . . . **163. G. hispida**
Capsule more or less globular; calyx lobes 0.8–1 mm wide, with a few marginal bristles; leaves 5–10 mm wide . . . . . **159. G. byrnesii**

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